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A search for OH 6 GHz maser emission towards southern supernova remnants

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Abstract. OH masers at 1720 MHz have proven to be excellent indicators of interactions between supernova remnants and molecular clouds. Recent calculations suggest that the 6049 MHz OH maser line is excited for higher column densities than for the 1720 MHz line. It is therefore a potentially valuable indicator of remnant-cloud interaction.

We present preliminary results of a survey using the Parkes Methanol Multibeam receiver for 6049 MHz and 6035/6030 MHz OH masers towards 36 supernova remnants and 4 fields in the Large and Small Magellanic Clouds. While no 6049 MHz masers have been found, three new sites of 6035 and 6030 MHz OH maser emission have been discovered in star-forming regions.

Keywords. supernova remnants, masers, stars: formation, radio lines: ISM

OH masers at 1720 MHz have proven to be an almost unambiguous indicator of the interaction between supernova remnants and molecular clouds (Frail et al. 1994). OH excitation calculations (Pavlakis & Kylafis 2000; Wardle, these proceedings) suggest that the 6049 MHz satellite line may be present at higher OH column densities where the 1720 MHz line is weak or absent.

A survey using the Parkes Methanol Multibeam receiver at 6049 and 6035/6030 MHz was conducted towards 36 supernova remnants and 4 fields in the Large and Small Magellanic Clouds. An 8 MHz bandwidth with 2048 channels was used, allowing a channel width of 0.2 km s^{-1}. The beam size is approximately 3.3 arcminutes and both circular polarisations were observed. Scans in right ascension and declination were conducted over the supernova remnants, with a total observing time in one direction of $\sim$100 minutes per square degree. The data was flux-calibrated, continuum subtracted and gridded using the programs Livedata and Gridzilla. The data cubes produced were searched for maser emission using the program Duchamp (Whiting 2007).

While preliminary analysis has not discovered any 6049 MHz maser emission, 5 maser sites at 6035 MHz have been identified (2 containing 6030 MHz emission as well). Masers 6.86-0.09, 34.27-0.20 and 48.98-0.30 are new discoveries (see Fig. 1), while 336.941-0.156 and 337.705-0.053 are already known (Caswell & Vaile 1995; Caswell 2001).

As left and right-hand circular polarisations (LHCP and RHCP) were observed, Zeeman pairs can be recognised. A 1 mG magnetic field produces splittings equivalent to 0.079 km s^{-1} and 0.056 km s^{-1} in the 6030 and 6035 MHz transitions respectively. The magnetic fields calculated can be found in Table 1 and have an uncertainty of approximately 2 mG.

The 6035 MHz maser discovered at 48.98-0.30 is approximately coincident with two H II regions and is likely to be associated with one of them. It is expected that the other 6030 and 6035 MHz masers are associated with star forming regions.

These results are preliminary and further analysis may yield weaker 6 GHz masers. In

Table 1. Masers at the 6035- and 6030- MHz OH transitions. The velocity and flux of the peaks are taken at the brightest peak, if multiple peaks are observed.

OH maser (l b) (° °)	RA (2000) (h m s)	Dec (2000) (° ′ ″)	6035 MHz Velocity Peak LHCP (km s^{-1})	RHCP	6035 MHz Peak flux LHCP (Jy)	RHCP	Magnetic Field (mG)	6030 MHz Peak (L and/or R) (Jy)
336.941-0.156	16 35 55.20	-47 38 45.4	-65.6	-65.1	3.35	1.86	+8.9	1.03 0.46
337.705-0.053	16 38 29.67	-47 00 35.8	-53.6	-50.7	1.63	2.22	-	-
6.86-0.09	18 00 48	-22 58 14	-2.37	-1.98	4.23	1.03	+7.0	-
34.27-0.20	18 54 36	+01 05 54	54.3	54.5	4.60	2.33	+3.6	1.76 (L)
48.98-0.30	19 22 27	+14 06 53	67.5	67.7	1.55	4.27	+3.6	-

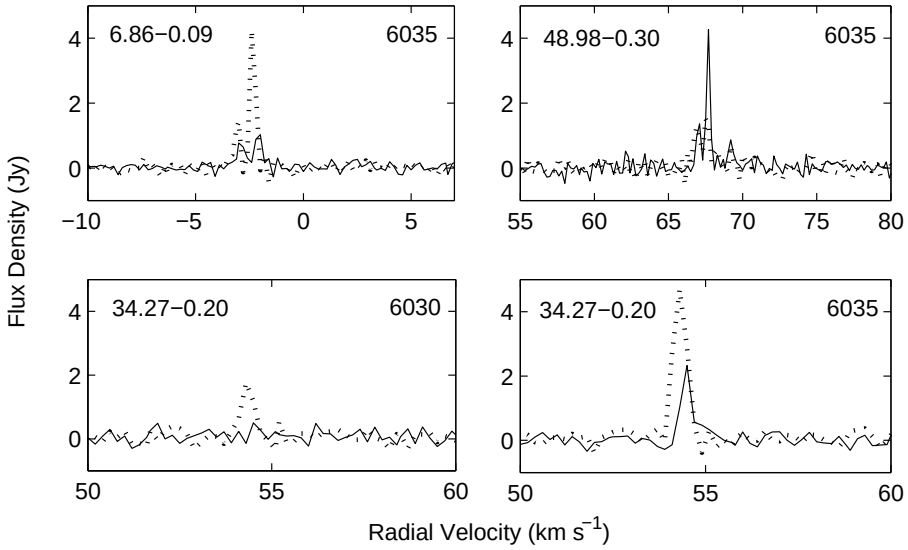

Figure 1. Spectra of new OH masers at the 6030- and 6035-MHz transitions. LHCP and RHCP are displayed as dashed and solid lines, respectively. The channel resolution is 0.2 km s^{-1} and the beamsize is approximately 3 arcminutes.

addition, data from ATCA observations of seventeen supernova remnants remain to be analysed.

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